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Coal power overcapacity and investment bubble in China during 2015–2020

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HIGHLIGHTS

- Assess the rational capacity of coal power in China by 2020.
- The number is within 960 GW under the 15% non-fossil primary energy target.
- All EIA approved projects built, the capacity would reach 1150 GW by 2020.
- 200 GW excess of coal power will bring forth disastrous consequences for China.

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ABSTRACT

Electricity consumption growth in China has experienced radical adjustment from high speed to medium speed with the advent of new economy normal. However, the investment enthusiasm on coal power remains unabated and leads to continuous operation efficiency deterioration in recent years. In this paper, we quantify the rational capacity and potential investment of coal power in China during the 13th FYP period (2016–2020). By employing power planning model and fully considering the power sector's contribution in the 15% non-fossil primary energy supply target by 2020, we estimate that the reasonable capacity addition space of coal power ranges between 50 GW and 100 GW, depending on the expected range of demand growth. We find that if all the coal power projects submitted for Environmental Impact Assessment (EIA) approval were put into operation in 2020, capacity excess would reach 200 GW. Such huge overcapacity will bring forth disastrous consequences, including enormous investment waste, poor economic performance of generators and more importantly, delay of low-carbon energy transition. Finally, policy recommendations are proposed to address this issue.

1. Introduction

The domination of coal in primary energy consumption makes China the largest greenhouse gases (GHG) emitter in the world. Extensive use of coal also leads to serious environmental damages. The outburst of nationwide severe air pollution haze has become a stubborn threat to public health (Pan et al., 2012; Deutsche Bank, 2013). Since 2013, controlling the growth of primary energy consumption (coal in particular) has become the major theme of China's national energy and environment policy (State Council, 2013). Meanwhile, in the end of 2014, a Sino-US Climate Change Communiqué was declared and the Chinese government announced its determination to peak CO_2 emissions by 2030 (Xinhua net, 2014a). Then in June of 2015, the determination was confirmed in China's INDCs submitted to the United Nations (Xinhua net, 2015).

Power sector holds pivotal role in sustainable energy system transition (Pacala and Socolow, 2004). This argument is particularly true for China where nearly half coal supply is used for power generation while more than 70% of electricity supply is produced from coal power plants (China Electricity Council, 2014a). Hence, the prospective of coal power is of particular policy importance to China's sustainable energy transition and China's climate change commitment.

With the advent of new economy normal (Yuan et al., 2015a), radical adjustment in electricity demand growth is witnessed in China. In 2014, with 7.8% GDP growth, total electricity consumption only grew by 3.8%, a historical low record since 1998 (China Electricity Council, 2015a). In 2015, the growth will certainly become more sluggish. Until the end of September, electricity consumption only grew by 0.8% in 2015 (China Electricity Council,

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2015b). Though such an extreme low growth is transient, change from high-speed to medium-speed is for certain, which provides very opportunity for China to curb coal power and integrate more renewable energy in the power sector.

However, persistent inconsistency between high coal power investment and sluggish electricity consumption growth prevails in China since 2014. According to the analysis of (China Electricity Council, 2015b), the incoordination will last for years. Meanwhile, the operation efficiency of coal power plants continues to deteriorate. The annual utilization hour of thermal power hit the low record of 4706 h in 2014 and is expected to further decrease by some 8% in 2015 (China Electricity Council, 2015a, 2015b).

In literature, many studies have explored China's electricity demand and power generation planning (Zhou et al., 2013; Hu et al., 2010, 2013; Yuan et al., 2014a; Zheng et al., 2014a; among others). However, most were conducted before 2014 and could not capture the new state of China's macro economy. There are three influential studies published in 2015, among which all are conducted by authoritative industry institution or government think tank. The first study, a CEC report presented comprehensive analysis on the sector in 2014 and concluded that total electricity consumption is expected to reach 7700TWh while per capita electricity consumption would reach 5570 KWh by 2020 (China Electricity Council, 2015a). The second study elaborated the assumptions on GDP electricity consumption elastic coefficient based upon international comparison and concluded that total electricity consumption would reach 7600–8000 TWh by 2020 (Wang and Wu, 2015). The consensus of these two studies is that coal power capacity would reach beyond 1100 GW by 2020 and 1350 GW by 2030 under the business-as-usual (BAU) projection. The third report by ERI NRDC (2015) constructed a High Renewable Penetration Scenario and concluded that with strong renewable penetration coal power capacity would be confined within 1050 GW by 2030. However, to the best of our knowledge, no existing papers have presented analysis on overcapacity and potential investment bubble issues in China's coal power sector. The study in this paper will add to the literature on this point.

The remainder of the paper will be organized as follows. Section 2 will address the methodology of this study. Section 3 will present the quantification result of the investment bubble and provide discussions around it. Section 4 concludes with policy implications.

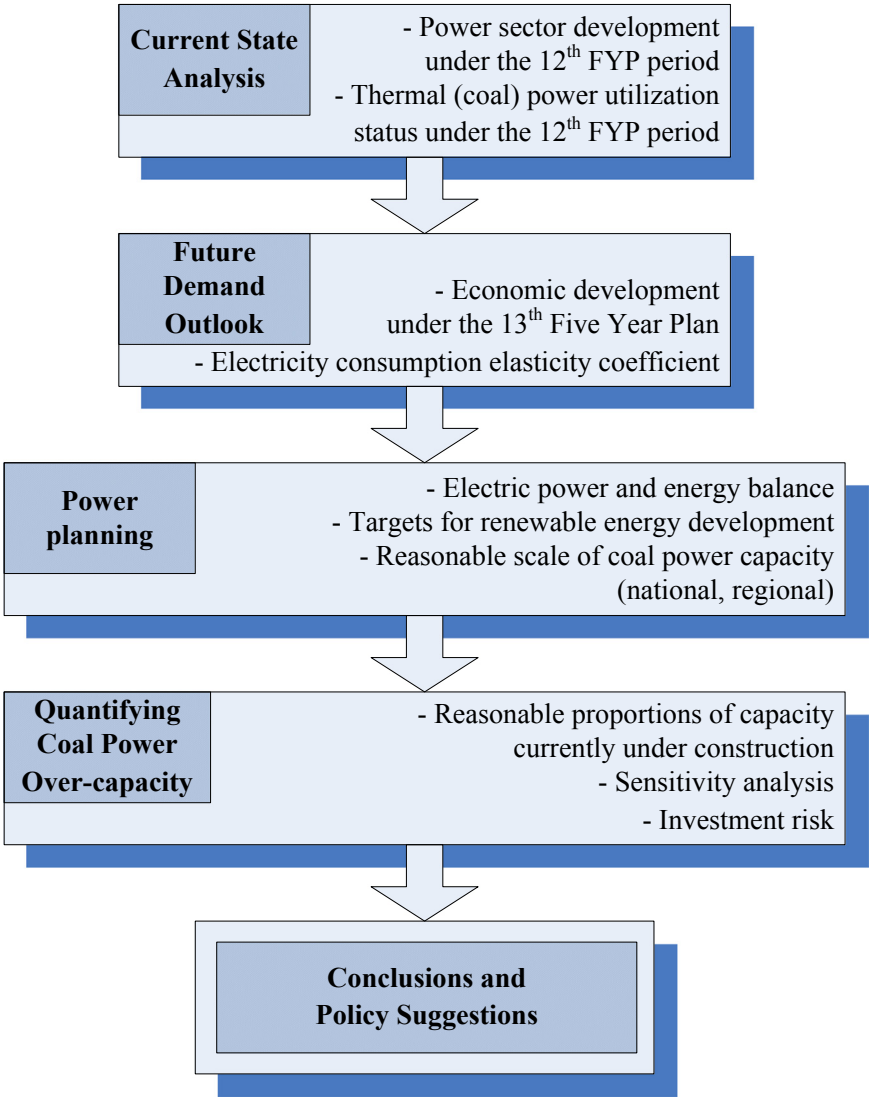

Fig. 1. The analytic framework of our study.

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